

SEXUAL DIMORPHISM IN THE COWBIRD, *MOLOTHRUS ATER*

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THE study of the physiological basis of sexual dimorphism in birds has interested experimental biologists for a considerable time. The different control mechanisms employed within the class Aves and often by closely related species add interesting considerations to our general concept of phylogeny.

So far as the Icteridae are concerned there has appeared only one other paper which deals with an analysis of the differences between the sexes. Danforth and Price (1935), working with the Brewer Blackbird (*Euphagus cyanocephalus*), found that the control of the feather pattern was entirely due to genetic factors and that the administration of hormones had no effect on the basic coloration.

Other authors have found the same condition to exist in widely separated groups. Still others have found that various hormonal relationships control the feather coloration in the two sexes. In some cases these are sex hormones, in others, hormones produced in the pituitary gland. Other cases are known wherein the control is partly genetic and partly hormonal.

The Cowbird exhibits marked sexual dimorphism in color pattern as well as in size. The male has a bronze head and neck, a jet black bill, dark brown iris, and a band of purplish black feathers surrounding the lower neck region and separating the bronze neck feathers from the greenish black plumage covering the remainder of the body. The breast and belly are also greenish black, while the wings and tail are not so prominently iridescent. In contrast to this striking plumage, the female has but a faint iridescence barely visible, when the light is right, on the dorsal feathers. Her plumage is gray with an almost white chin and generally light gray underparts. None of the color pattern described above for the male is apparent in the female. The iris of the female is a shade lighter brown than that of the male, while the beak is blue slate as compared to the jet black bill of the male.

According to our observations on birds kept in the laboratory for 20 months, Cowbirds do not assume a special nuptial plumage in either sex. Two complete moults have occurred during this time, each new plumage being exactly like that which preceded it.

In the wild state, during the summer months the feathers fade considerably. In captivity, when given adequate protection from the sun, the feathers retain their lustre for the duration of the plumage.

Oberholser (1938) gives a meager description of the Louisiana Cowbird, *Molothrus ater buphilus*, but records no measurements of females and no data on weights of either sex. While our

material may be referred to this subspecies on the basis of comparisons with specimens in the Louisiana State University museum, the difficulty of comparing living material with museum specimens renders the subspecific identity of our birds uncertain, and for the purposes of this paper it is probably unimportant. It is also entirely possible that these birds are migrants of the subspecies *ater*.

MATERIAL AND METHODS

During the latter part of January, 1939, about 150 Cowbirds were captured in a drop-door trap used principally for taking English Sparrows during the remainder of the year.

Six or eight birds were placed together in hardware-cloth cages which allowed approximately one square foot of perching space to each bird. The sexes were kept apart in some cases, but both males and females were kept together in others. The two sexes of the experimental groups were kept separately and were also separated from the controls. They were easily maintained on a balanced chick-mash diet with fresh water daily. They soon became adjusted to captivity, as evidenced by their song and quiet behavior. These qualities make the Cowbird a satisfactory laboratory bird in contrast with the English Sparrow or Red-winged Blackbird which in our experience never become tractable.

The birds were weighed as soon as they were captured and it was found that the males averaged about 50 grams, ranging from 42 to 65 grams. The females averaged about 40 grams, ranging from 35 to 45 grams.

EXPERIMENTS

A series of males and females were castrated and parts of the sexually dimorphic tracts were plucked in the males along with the homologous tracts in the females. Depluming was performed at the time of castration and the regenerating feathers were observed.

In a second series, males and females were castrated, plucked as above and the plucked areas were swabbed daily for five consecutive days with theelin¹ in oil in the male castrates and perandren (testosterone propionate) in the female castrates. The regenerating feathers were noted. A series of normal males and females were plucked as above and served as controls. The results of these experiments² are listed below.

Examination of the results recorded in Table 1 shows that the female feathers in all cases regenerated the same type after castration as before. Perandren (testosterone propionate) had no effect. The male feathers

¹ We are indebted to Ciba Pharmaceutical Products, Inc. of Summit, N. J. for the perandren (testosterone propionate) and to Parke Davis Co., Detroit, Mich., for the theelin used in these experiments.

² Made with the technical assistance of J. A. Michaud and Harry Grubschmidt.

TABLE 1
CASTRATION EXPERIMENTS ON MALE AND FEMALE COWBIRDS

Sex	No.	Treatment	Feather regeneration
Male	5	Head, neck, breast, wing and tail plucked.	Normal with gray tips on breast feathers.
Male (castrate)	5	Head, neck, breast, wing and tail plucked.	Normal with gray tips on breast feathers.
Male (castrate)	5	Plucked as above and swabbed with theelin in oil.	Normal with gray tips on breast feathers.
Female	5	Head, neck, breast, wing and tail plucked.	Normal in each tract.
Female (castrate)	5	Head, neck, breast, wing and tail plucked.	Normal in each tract.
Female (castrate)	2	Plucked as above and swabbed with perandren (testosterone propionate).	Normal in each tract.

which came in after depluming were also alike in all homologous tracts; however, the new breast and saddle feathers in all cases came in with short gray tips which wore off in two months, leaving the normal feather. This seems to be a normal characteristic for these tracts in the male Cowbird, and is similar in this respect to the dark throat and breast tract of the male English Sparrow as figured by Miller (1935), except that the light tip is not nearly so long, does not mask the darker plumage beneath, and gives only a temporary mottled effect to the regenerated area.

The color of the irides of both sexes remained unchanged.

The bill color of 20-month castrates of both sexes is slightly lighter than that of controls, but no such striking change occurs as is found in castrates of the English Sparrow, in which the jet-black bill of the breeding male becomes light horn-colored after castration or after the quiescent testicular phase becomes established. (Keck, 1934; Witschi, 1936)

At the time of castration (from February 3 to March 1, 1939) the gonads were in the quiescent state. Testis weights were at the minimum and ranged from .6 mg. to 1.1 mg. for both glands. The gonads begin to enlarge gradually, however, at about this time, so that by April 15 they are from 50 to 100 times heavier than they were thirty to forty-five days earlier. Testis weights taken at this time ranged from 23.4 mg. to 108.4 mg. Captivity had no visible effect on the normal increase in size of the gonads. No singing was noted in the castrate birds, probably due to the low concentrations of the hormones used.

CONCLUSIONS

The Cowbird exhibits marked sexual dimorphism in both color pattern and size. The males were found to be 25 per cent heavier than females.

The color of male feather tracts is not suppressed by theelin, and likewise neither castration alone nor perandren (testosterone propionate) has any effect in female castrates.

Bill color of Cowbirds is only slightly affected by castration, and the color of the iris is unchanged.

Since the differences in the sexually dimorphic feather tracts of the two sexes of the Cowbird are not under the control of the sex hormones, sexual dimorphism in the Cowbird is considered to be determined genetically as was found for the Brewer Blackbird by Danforth and Price in 1935.

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